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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/542,616	07/18/2005	Teodor Aastrup	066935-076983	7334

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EXAMINER	
FITZGERALD, JOHN P	
ART UNIT	PAPER NUMBER
2856	

MAIL DATE	DELIVERY MODE
04/15/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/542,616	AASTRUP ET AL.	
	Examiner	Art Unit	
	JOHN FITZGERALD	2856	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 March 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13 and 23-28* is/are pending in the application.

4a) Of the above claim(s) *6,7 and 11-13* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,8-10 and 23-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 July 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 21 March 2008 has been entered.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1-5, 8-10 and 25-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2003/0076743 A1 to Thompson et al. Thompson et al. disclose a thickness shear mode (TSM) piezoelectric resonator for use in a sensor arrangement for detecting or measuring an analyte in a medium, i.e. in a method of sensing and measuring using the TSM, as recited in claim 23), employed to measure both gas and liquid samples (as recited in claim 24) by mass changes, including a quartz crystal plate (see Fig. 4 below) having two flat (as recited in claim 10) crystal surfaces (first and second) wherein the first crystal surface has a first electrode having an edge and a second crystal surface having a second electrode (as recited in claim 1), and wherein the first crystal surface has a first contacting area connected to the first electrode, as well as the second crystal surface and the second electrode (as recited in claims 8 and 9); wherein the

area of the first electrode is smaller than the first crystal surface area and where the first electrode has a surface area that is 0.1-90% of the crystal area (see Fig. 4 below) (as recited in claims 3 and 26). Thompson et al. does not specifically disclose quantitative measures of the electrodes, i.e. the first crystal surface having a first electrode having a surface area of less than 15mm^2, 10 mm^2 or 1-5 mm (as recited in claims 1, 2, 25), Thompson et al. do disclose an electrode that is 'at least' 0.05 mm^2 in area (i.e. electrode diameter of 5 mm, thus an area of 19.63 mm^2) (as recited in claim 3) (see paragraph 0033), or specific measures of distances between the crystal plate edge and of the electrode being 0.2 mm, 1mm or 2mm) (as recited in claims 5, 27 and 28). However, Thompson et al. do disclose teachings in regards to the variation and modification of geometry of the electrode(s), in particular, their total surface area, as well as perimeter edge distances between the electrode and crystal edge (see paragraphs 0021, 0030, 0031, 0043-0046). In particular, Thompson et al. disclose that to investigate the effect of modification of the electrode geometry (i.e. total surface area and edge effects) on the sensitivity of the TSM device, disks of 1.5 mm diameter (thus equating to the removal of area of 1.77 mm^2) were removed from different locations of the electrode (see paragraph 0043). Thompson et al. further disclose that the two electrodes can have different total areas, i.e. one electrode having a larger surface area than the other that is mounted on the opposite side of the crystal plate (see paragraph 0014-0015) as well as a functional relationship regarding the frequency response based on the difference of those areas (see equation 5). Thompson et al. further teach that removal (or etching) of the electrode(s) (i.e. removal of mass from the electrode) by etching radial lines will effect the response of the TSM device, based on the Sauerbrey equation ($\Delta f = -2\Delta m f^2 / A(\mu\rho)^{1/2}$ where: the change in frequency is proportional to a change in mass

and area of the electrode) (paragraph 0048). It would have been obvious to one having ordinary skill in the art at the time the invention was made to alter the geometry of the electrode(s), including, but not limited to, varying the total surface area of the electrode(s) and/or modifying the electrode edge perimeter and/or distance from the electrode to the quartz plate edge, thus meeting all the dimensional limitations of claims 1-3, 5 and 25-28, to raise the intensity of edge fields which will, in turn, enhance the sensitivity of the TSM device (paragraphs 0044 and 0046). Furthermore, it would be obvious to one of ordinary skill in the art at the time the invention was made to alter/modify the geometry of the electrode(s) based on the Sauerbrey equation, since it directly relates the change frequency response (Δf) of the TSM device to a change in mass (m) and area (A) of the electrode(s), thus providing one of ordinary skill in the art the basis of specifically designing a TSM device to have a specific desired output change in frequency based on the change in mass and area of the electrode(s) being employed in measuring or detecting an analyte via mass changes.

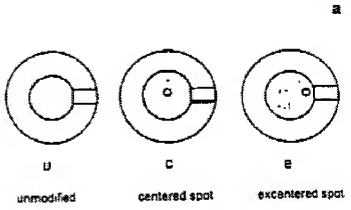

Fig. 4
Thompson et al.

4. Claims 1-5, 8-10 and 25-28 are rejected under 35 U.S.C. § 103(a) as being unpatentable over US 5,852,229 to Josse et al. Josse et al. disclose a thickness shear mode (TSM) piezoelectric resonator and method for use in detecting/measuring an analyte by mass changes (see Josse et al.: col. col. 2, lines 14-25, that it is well known in the art to employ similar devices for detecting and/or sensing, mass detection for very small masses, film thickness monitoring, microbe and similar biological sensing, frequency control, viscosity and density) in a medium (capable of use with any fluid (i.e. liquids and gases) (as recited in claim 24) (see Figs 1a-1c below) having a quartz crystal plate (15) having two flat (as recited in claim 10) crystal surfaces (first and second) wherein the first crystal surface comprises a first electrode (20) having a surface area smaller than the surface are of a second electrode (30) on the second crystal surface (as recited in claim 4) and wherein the first crystal surface has a first contacting area connected to the first electrode, as well as the second crystal surface and second electrode (as recited in claims 8 and 9). Although Josse et al. does not discloses specific quantitative surface areas of the electrode(s) , that is, specific dimensional/geometrical aspects of the electrode(s) (i.e. surface area < 15 mm^2 or 10 mm^2 or at least 0.05 mm^2 or is 1-5 mm^2 or the distances between the crystal edge and the electrode edge being at least 0.2 mm or 1 mm or 2mm) (as recited in claims 1-3, 5 and 25-28), Josse et al. does carefully teach and explain that 'conductivity of the loading medium results in the expansion of the effective electrode surface area, and that the electroded regions and their electrostatic capacitance is a result of the electrode size, shape and configuration, in other words, the electrode surface area. Josse et al. further teach that the geometries and/or surface areas of the first and second electrodes must differ and that the variations affect the critical frequencies in a predictable way. It is well know in the art that the

variations in electrode structure (i.e. total mass and/or area) can increase the sensitivity of the resonator, the ability to sense a variety of materials of interest and the ability to determine concentration of one or more materials of interest. Lastly, the variations in electrode sizes affect the resonant frequencies and anti-resonant frequencies. For example, a TSM having a larger electrode area, and thus larger total mass of electrode, will vibrate differently (i.e. have a different frequency response or resonance frequency characteristics) than that of a TSM having a smaller electrode area and smaller total mass. This is just simple basic physics. These well known variations for quartz type resonators, i.e. changes in geometry (i.e. area and thus edge distances between the electrode(s) and the quartz plate edge) that lead to changes in frequency response are actually calculable and predictable based on the well known Sauerbrey equation:

$$(\Delta f = -2\Delta m f^2 / A(\mu\rho)^{1/2}$$

Δf: change of frequency of vibration (i.e. response)
f: frequency of basic vibration
Δm: change of mass
A: area of electrode
μ: elastic modulus of torsion of quartz
ρ: density of quartz

5. It should be understood, that the change in mass (Δm) Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to vary the size/surface area/geometry of first electrode to any desired size/area depending on desired analytes (i.e. change in mass (Δm) in the Sauerbrey eqn.) to be measured and desired frequencies of operation, meeting the limitations of claims 1-3, 5 and 25-28).

Response to Arguments

6. Applicant's arguments filed 21 March 2008 have been fully considered but they are not persuasive.

In view of the new rejections made by the Examiner, most, if not all of the arguments made by the Applicant are rendered moot, most specifically, that the Examiner has made an unsupported assertion that the teachings of Josse et al. coupled with the knowledge of one of ordinary skill in the art, renders the limitations recited in instant claim 1 non-obvious. Cleary, the teachings of Josse et al. coupled with the well known Sauerbrey equation which directly relates a change in frequency response by the TSM device is directly proportional to a change in mass as well as the total area of the electrode, one of ordinary skill is well equipped to design and or modify the electrode size (i.e. area) to obtain a desired frequency response or change in frequency response. The Aastrup Declaration does not alter the basic facts and evidence presented by the Examiner. These facts being that one of ordinary skill in the art is well aware that alterations in the geometry of the electrode will lead to alterations in the frequency response of the TSM device and that the Examiner ***is not required*** (emphasis added) to provide a "reasonable expectation of success" of the combination of the Josse et al. teachings and the knowledge of one of ordinary skill in the art holds. The Examiner's burden is only to provide a reasonable motivation for a combination of two or more prior art references, or the modification of a single prior art reference. Simply because Applicant makes the argument that "surprising and unexpected results" were obtained does not, in fact, make it so. The reason or motivation to modify a reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem (In the instant case, to modify the electrode area based on the teachings of

Josse et al. and the knowledge of one having ordinary skill in the art). It is not necessary that the prior art suggest the combination and/or modification to achieve the same advantage or result discovered by the applicant, in this case, the so-called "surprising and unexpected results" of employing a TSM device having an electrode having the specific geometry as claimed. See, e.g., In re Kahn, 441 F.3d 977, 987, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006) (motivation question arises in the context of the general problem confronting the inventor rather than the specific problem solved by the invention); Cross Med. Prods., Inc. v. Medtronic Sofamor Danek, Inc., 424 F.3d 1293, 1323, 76 USPQ2d 1662, 1685 (Fed. Cir. 2005) ("One of ordinary skill in the art need not see the identical problem addressed in a prior art reference to be motivated to apply its teachings."); In re Linter, 458 F.2d 1013, 173 USPQ 560 (CCPA 1972) (discussed below); In re Dillon, 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), cert. denied, 500 U.S. 904 (1991)

7. The examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, one of ordinary skill in the art is well aware of the basic underlying physics of the operation of TSM devices, as illustrated by the Sauerbrey equation, as well as the basic physical facts that electrodes having different total areas will respond differently based on that total area, since the total mass that is vibrating is different, thus leading to different frequency responses.

8. The Applicant dismisses the Examiner's employment of the recent KSR decision, which is clearly applicable in the instant case. Simply because that a single prior art reference was employed, coupled with the knowledge of one having ordinary skill in the art, does not render the KSR decision statements inapplicable. The KSR court has recognized that "[w]hen there is a design need or market pressure to solve a problem (i.e. a particular frequency response of the TSM device) there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options (in this case alterations of the area of the electrodes to obtain different response characteristics) within his or her technical grasp." KSR 127 S. Ct. at 1742. In such circumstances, "the fact that a combination was obvious to try might show that it is obvious under 103." Id. Clearly, one of ordinary skill in the art at the time the invention was made is well aware employing the basic physics of the problem (as well as the Sauerbrey eqn.) to modify the TSM resonator disclosed by Josse et al., most notably, the total area of the electrode(s) to obtain different desired response characteristics.

9. Furthermore, the rationale to support a rejection under 103 may rely on logic and sound scientific principle. *In re Soli*, 317 F.2d 941, 137 USPQ 797 (CCPA 1963). However, when an examiner relies on a scientific theory, evidentiary support for the existence of that theory must be provided, as the Examiner has done. *In re Grose*, 692 F.2d 1161, 201 USPQ 57 (CCPA 1979). The rationale to modify or combine the prior art does not have to be expressly stated in the prior art; the rationale may be expressly or impliedly contained in the prior art or it may be reasoned from knowledge generally available to one of ordinary skill in the art, established scientific principles, or legal precedent established by prior case law. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 159 6 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

See also *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) (setting forth test for implicit teachings); *In re Eli Lilly & Co.*, 902 F.2d reliance on legal precedent); *In re Nilssen*, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988) (references do not have to explicitly suggest combining teachings); *Ex parte Clapp*, 227 USPQ 972 (Bd. Pat. App. & Int. 1985) (examiner must present convincing line of reasoning supporting the rejection); and *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Int. 1993) (reliance on logic and sound scientific reasoning). In the instant case, the Examiner has provided an excellent and convincing line of reasoning supporting the rejection based on the coupling of knowledge of one having ordinary skill in the art to modify the Josse et al. reference.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Applicant is invited to review PTO form 892 accompanying this Office Action listing Prior Art relevant to the instant invention cited by the Examiner.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Fitzgerald whose telephone number is (571) 272-2843. The examiner can normally be reached on Monday-Friday from 7:00 AM to 3:30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hezron Williams, can be reached on (571) 272-2208. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or

Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/John Fitzgerald/
Examiner, Art Unit 2856